Substitute Sequence Listing

<110> VERMEIJ, Paul

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<151> 2005-01-18

<150> EP 04100202.3
<151> 2004-01-22

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Gly Leu Leu Ser His Gly Glu Lys Met Asn Val Ile Gly Asn Asn Ile

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gct aac gta aat aca gta ggc ttt aaa ggc caa cgt atg gat ttc gca      147
Ala Asn Val Asn Thr Val Gly Phe Lys Gly Gln Arg Met Asp Phe Ala
    30                  35                  40

gac ttt att tat caa gat ggc ttt agt act gca ggg att aca caa att      195
Asp Phe Ile Tyr Gln Asp Gly Phe Ser Thr Ala Gly Ile Thr Gln Ile
45                  50                  55                  60

gga cgt ggt gta ggc att gga gct gtc atg ggg aac ttt ggt cag ggt      243
Gly Arg Gly Val Gly Ile Gly Ala Val Met Gly Asn Phe Gly Gln Gly
                65                  70                  75

agt ttt gaa acc aca act gaa gca aca gac ctt gct att ggt ggt cgt      291
Ser Phe Glu Thr Thr Thr Glu Ala Thr Asp Leu Ala Ile Gly Gly Arg
            80                  85                  90

gga ttt ttc aaa gtt aaa cca caa gga tca gag act tca tat tat acc      339
Gly Phe Phe Lys Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr
        95                  100                 105

cgt gca ggt aat ttt cgt ttt aat aat gat gga tac tta gtt gat cct      387
Arg Ala Gly Asn Phe Arg Phe Asn Asn Asp Gly Tyr Leu Val Asp Pro
    110                 115                 120

cat gga tat gct ctt cag ggt tgg aaa att gat aat act gaa ggg cca      435
His Gly Tyr Ala Leu Gln Gly Trp Lys Ile Asp Asn Thr Glu Gly Pro
125                 130                 135                 140

caa cgt atc tca ggt ggt gtt aat cca ggt aca aat act tcg cag att      483
Gln Arg Ile Ser Gly Gly Val Asn Pro Gly Thr Asn Thr Ser Gln Ile
                145                 150                 155

atg ggt aca ggt gaa cca aca gat atc cgt ctt gat act tgg aca gtt      531
Met Gly Thr Gly Glu Pro Thr Asp Ile Arg Leu Asp Thr Trp Thr Val
            160                 165                 170

gca cct tta cag aca aca aat gta agt ttt aac gta aac ctt tct tct      579
Ala Pro Leu Gln Thr Thr Asn Val Ser Phe Asn Val Asn Leu Ser Ser
        175                 180                 185

gat aaa tct gga gat aaa tct caa aac gtt aat agt cca ttt acc tca      627
Asp Lys Ser Gly Asp Lys Ser Gln Asn Val Asn Ser Pro Phe Thr Ser
    190                 195                 200

tta ttt aat ata tgg aat ggt aaa caa cca agt gaa cct aac aat cca      675
Leu Phe Asn Ile Trp Asn Gly Lys Gln Pro Ser Glu Pro Asn Asn Pro
205                 210                 215                 220

cct atg cct gaa agt gca tat agt tat cag aca tct att aag gta tat      723
Pro Met Pro Glu Ser Ala Tyr Ser Tyr Gln Thr Ser Ile Lys Val Tyr
                225                 230                 235

gat gaa gct ggt gga aca cat aca tta aca gtc tat ttt gac caa gtt      771
Asp Glu Ala Gly Gly Thr His Thr Leu Thr Val Tyr Phe Asp Gln Val
            240                 245                 250

tct cct aaa gac tac aaa ggt ggt gga agt gga gaa agt gta tgg gaa      819
Ser Pro Lys Asp Tyr Lys Gly Gly Gly Ser Gly Glu Ser Val Trp Glu
        255                 260                 265

tac gtt gtt act atg gat cct tct gaa gat aat cgc caa gtt tct gtt      867
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Tyr Val Val Thr Met Asp Pro Ser Glu Asp Asn Arg Gln Val Ser Val
    270                 275                 280

ggt ggt aac att gtg gac atc aaa gat act aaa gct gca gga atg tta      915
Gly Gly Asn Ile Val Asp Ile Lys Asp Thr Lys Ala Ala Gly Met Leu
285                 290                 295                 300

atg tca gga aca ttg agt ttt gat agc tca gga aaa ctt gca aac caa      963
Met Ser Gly Thr Leu Ser Phe Asp Ser Ser Gly Lys Leu Ala Asn Gln
                305                 310                 315

agt gca tat tcg ctg aat ggt tca cgt aag cct gca gtt gat cct gca     1011
Ser Ala Tyr Ser Leu Asn Gly Ser Arg Lys Pro Ala Val Asp Pro Ala
            320                 325                 330

acc gga gct ctt att aat ggt aat ggt ttt act att gat aga gat gga     1059
Thr Gly Ala Leu Ile Asn Gly Asn Gly Phe Thr Ile Asp Arg Asp Gly
        335                 340                 345

aat gca att cct att ctt aat ata gat aat cca gct gaa aac ttc tat     1107
Asn Ala Ile Pro Ile Leu Asn Ile Asp Asn Pro Ala Glu Asn Phe Tyr
    350                 355                 360

cca gca gaa gtt tct aat aat gga ttt cct atg att gta gct aat ttt     1155
Pro Ala Glu Val Ser Asn Asn Gly Phe Pro Met Ile Val Ala Asn Phe
365                 370                 375                 380

act ggt gtc cca ggt aaa aat aca gct gga tct gtt ggt gat gct acc     1203
Thr Gly Val Pro Gly Lys Asn Thr Ala Gly Ser Val Gly Asp Ala Thr
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acc ttt ttt aca gaa att gac ttt ggt tta aaa gct act gat ctt gat     1251
Thr Phe Phe Thr Glu Ile Asp Phe Gly Leu Lys Ala Thr Asp Leu Asp
            400                 405                 410

aat aca tgg aag aat gca aat gaa cct ctt tct tct tta agc tat aaa     1299
Asn Thr Trp Lys Asn Ala Asn Glu Pro Leu Ser Ser Leu Ser Tyr Lys
        415                 420                 425

aaa aca cat aat cct atg gat gtc gca ggt ggt tgg aca gtt ggt ggg     1347
Lys Thr His Asn Pro Met Asp Val Ala Gly Gly Trp Thr Val Gly Gly
    430                 435                 440

tat aaa act cca gct cca tca gta act gaa ctt ggt atg gct cag ata     1395
Tyr Lys Thr Pro Ala Pro Ser Val Thr Glu Leu Gly Met Ala Gln Ile
445                 450                 455                 460

ttg gaa aat cct gct ggg gta atg cca caa tat tat ttt ggt aac cct     1443
Leu Glu Asn Pro Ala Gly Val Met Pro Gln Tyr Tyr Phe Gly Asn Pro
                465                 470                 475

aac tat gat aac aca gtt cca cag agt cca cca tat gta tat aaa aat     1491
Asn Tyr Asp Asn Thr Val Pro Gln Ser Pro Pro Tyr Val Tyr Lys Asn
            480                 485                 490

gaa gct tct tat cag gct gca tat aag act gca tta act gcc gca ggt     1539
Glu Ala Ser Tyr Gln Ala Ala Tyr Lys Thr Ala Leu Thr Ala Ala Gly
        495                 500                 505

ggt acc gca gct gac att aaa aag gaa cat tgg cct cat aat gct gca     1587
Gly Thr Ala Ala Asp Ile Lys Lys Glu His Trp Pro His Asn Ala Ala
    510                 515                 520
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tca ggt ata tta gaa gct aat gat cca cca aat gtt aaa gac tta gct      1635
Ser Gly Ile Leu Glu Ala Asn Asp Pro Pro Asn Val Lys Asp Leu Ala
525                 530                 535                 540

aat atg aat gga aca cca aac cgc tta tca aat gcg ttt act aac tat      1683
Asn Met Asn Gly Thr Pro Asn Arg Leu Ser Asn Ala Phe Thr Asn Tyr
                545                 550                 555

gca ggt ggt agc tct aca aaa tct gca agt caa aat ggt tat ggt ttt      1731
Ala Gly Gly Ser Ser Thr Lys Ser Ala Ser Gln Asn Gly Tyr Gly Phe
            560                 565                 570

ggt gat tta atg aac tat agt gta aat gct gag gga gtg tta ttt gga      1779
Gly Asp Leu Met Asn Tyr Ser Val Asn Ala Glu Gly Val Leu Phe Gly
        575                 580                 585

gta tat tca aat gga gta caa ctt cca tta tat caa gta gct ctt tat      1827
Val Tyr Ser Asn Gly Val Gln Leu Pro Leu Tyr Gln Val Ala Leu Tyr
    590                 595                 600

gat ttt aac tct aaa cag ggg tta cgt cgt gaa ggt ggt aac tta ttt      1875
Asp Phe Asn Ser Lys Gln Gly Leu Arg Arg Glu Gly Gly Asn Leu Phe
605                 610                 615                 620

agt caa aca aga gaa tca ggg gac cca tct tca ggt gct gca aac act      1923
Ser Gln Thr Arg Glu Ser Gly Asp Pro Ser Ser Gly Ala Ala Asn Thr
                625                 630                 635

tct ggg ttt ggt tca att aac gct aat act tta gaa gga tca aac gta      1971
Ser Gly Phe Gly Ser Ile Asn Ala Asn Thr Leu Glu Gly Ser Asn Val
            640                 645                 650

gat ata tct aca gag ttt gtc tca atg att gca aca caa cgt gga ttc      2019
Asp Ile Ser Thr Glu Phe Val Ser Met Ile Ala Thr Gln Arg Gly Phe
        655                 660                 665

cag tca aat agt aaa att gta act act att gac caa atg tta gag aca      2067
Gln Ser Asn Ser Lys Ile Val Thr Thr Ile Asp Gln Met Leu Glu Thr
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Thr Val Gly Phe Lys Gly Gln Arg Met Asp Phe Ala Asp Phe Ile Tyr
        35                  40                  45
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Gln Asp Gly Phe Ser Thr Ala Gly Ile Thr Gln Ile Gly Arg Gly Val
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Gly Ile Gly Ala Val Met Gly Asn Phe Gly Gln Gly Ser Phe Glu Thr
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Thr Thr Glu Ala Thr Asp Leu Ala Ile Gly Gly Arg Gly Phe Phe Lys
85 90 95

Val Lys Pro Gln Gly Ser Glu Thr Ser Tyr Tyr Thr Arg Ala Gly Asn
100 105 110

Phe Arg Phe Asn Asn Asp Gly Tyr Leu Val Asp Pro His Gly Tyr Ala
115 120 125

Leu Gln Gly Trp Lys Ile Asp Asn Thr Glu Gly Pro Gln Arg Ile Ser
130 135 140

Gly Gly Val Asn Pro Gly Thr Asn Thr Ser Gln Ile Met Gly Thr Gly
145 150 155 160

Glu Pro Thr Asp Ile Arg Leu Asp Thr Trp Thr Val Ala Pro Leu Gln
165 170 175

Thr Thr Asn Val Ser Phe Asn Val Asn Leu Ser Ser Asp Lys Ser Gly
180 185 190

Asp Lys Ser Gln Asn Val Asn Ser Pro Phe Thr Ser Leu Phe Asn Ile
195 200 205

Trp Asn Gly Lys Gln Pro Ser Glu Pro Asn Asn Pro Pro Met Pro Glu
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Ser Ala Tyr Ser Tyr Gln Thr Ser Ile Lys Val Tyr Asp Glu Ala Gly
225 230 235 240

Gly Thr His Thr Leu Thr Val Tyr Phe Asp Gln Val Ser Pro Lys Asp
245 250 255

Tyr Lys Gly Gly Gly Ser Gly Glu Ser Val Trp Glu Tyr Val Val Thr
260 265 270

Met Asp Pro Ser Glu Asp Asn Arg Gln Val Ser Val Gly Gly Asn Ile
275 280 285

Val Asp Ile Lys Asp Thr Lys Ala Ala Gly Met Leu Met Ser Gly Thr
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Leu Ser Phe Asp Ser Ser Gly Lys Leu Ala Asn Gln Ser Ala Tyr Ser
305 310 315 320

Leu Asn Gly Ser Arg Lys Pro Ala Val Asp Pro Ala Thr Gly Ala Leu
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340 345 350

Ile Leu Asn Ile Asp Asn Pro Ala Glu Asn Phe Tyr Pro Ala Glu Val
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Ser Asn Asn Gly Phe Pro Met Ile Val Ala Asn Phe Thr Gly Val Pro
370 375 380

Gly Lys Asn Thr Ala Gly Ser Val Gly Asp Ala Thr Thr Phe Phe Thr
385 390 395 400

Glu Ile Asp Phe Gly Leu Lys Ala Thr Asp Leu Asp Asn Thr Trp Lys
405 410 415

Asn Ala Asn Glu Pro Leu Ser Ser Leu Ser Tyr Lys Lys Thr His Asn
420 425 430

Pro Met Asp Val Ala Gly Gly Trp Thr Val Gly Gly Tyr Lys Thr Pro
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Ala Pro Ser Val Thr Glu Leu Gly Met Ala Gln Ile Leu Glu Asn Pro
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Ala Gly Val Met Pro Gln Tyr Tyr Phe Gly Asn Pro Asn Tyr Asp Asn
465 470 475 480

Thr Val Pro Gln Ser Pro Pro Tyr Val Tyr Lys Asn Glu Ala Ser Tyr
485 490 495

Gln Ala Ala Tyr Lys Thr Ala Leu Thr Ala Ala Gly Gly Thr Ala Ala
500 505 510

Asp Ile Lys Lys Glu His Trp Pro His Asn Ala Ala Ser Gly Ile Leu
515 520 525

Glu Ala Asn Asp Pro Pro Asn Val Lys Asp Leu Ala Asn Met Asn Gly
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Thr Pro Asn Arg Leu Ser Asn Ala Phe Thr Asn Tyr Ala Gly Gly Ser

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Ser Thr Lys Ser Ala Ser Gln Asn Gly Tyr Gly Phe Gly Asp Leu Met
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580 585 590

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595 600 605

Lys Gln Gly Leu Arg Arg Glu Gly Gly Asn Leu Phe Ser Gln Thr Arg
610 615 620

Glu Ser Gly Asp Pro Ser Ser Gly Ala Ala Asn Thr Ser Gly Phe Gly
625 630 635 640

Ser Ile Asn Ala Asn Thr Leu Glu Gly Ser Asn Val Asp Ile Ser Thr
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Glu Phe Val Ser Met Ile Ala Thr Gln Arg Gly Phe Gln Ser Asn Ser
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Phe Thr Val Gly Ile Ile Met Leu Ile Leu Ala Cys Leu Ala Ala Leu
10 15 20

gag ttc ata caa gat ttt ccc aat agc tat caa gaa gat gga caa atg 148
Glu Phe Ile Gln Asp Phe Pro Asn Ser Tyr Gln Glu Asp Gly Gln Met
25 30 35

gtt aca gga att att tca aaa ata ata ggc tct aac tgt gat aat tct 196

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Ser Thr Ser Asp Ile Asn Asn Lys Lys Ser Ile Asp Arg Asp Lys Asp
                60                  65                  70

aca tta ctc tca agt agt aat aga aat aca ata caa gcc ggt act cca      292
Thr Leu Leu Ser Ser Ser Asn Arg Asn Thr Ile Gln Ala Gly Thr Pro
            75                  80                  85

cat caa gaa aat aac ata aaa gaa gat ctt caa ctg act aac aaa aat      340
His Gln Glu Asn Asn Ile Lys Glu Asp Leu Gln Leu Thr Asn Lys Asn
        90                  95                  100

gaa caa aca act cca gaa gaa gaa gaa gaa agt aaa ttt att tgg tta      388
Glu Gln Thr Thr Pro Glu Glu Glu Glu Glu Ser Lys Phe Ile Trp Leu
    105                 110                 115

aca gaa gct cca tca gag ctt aaa aaa gga gaa aaa gct ata aca caa      436
Thr Glu Ala Pro Ser Glu Leu Lys Lys Gly Glu Lys Ala Ile Thr Gln
120                 125                 130                 135

aca aga ttg tct att ggt aag gat ata tct ttt aga att act gct gat      484
Thr Arg Leu Ser Ile Gly Lys Asp Ile Ser Phe Arg Ile Thr Ala Asp
                140                 145                 150

gat gcc atc aaa gct caa tca atg atg tta aaa aat cca gat agg ttt      532
Asp Ala Ile Lys Ala Gln Ser Met Met Leu Lys Asn Pro Asp Arg Phe
            155                 160                 165

gtt tta gat ctt caa gga aag tgg ggt att tcc ctt cca cct att cca      580
Val Leu Asp Leu Gln Gly Lys Trp Gly Ile Ser Leu Pro Pro Ile Pro
        170                 175                 180

cct aca aat cct tgg tta aaa aaa ata cgc tta ggt act aat aat gga      628
Pro Thr Asn Pro Trp Leu Lys Lys Ile Arg Leu Gly Thr Asn Asn Gly
    185                 190                 195

aat aca cga ctt gtc ttt gat ctt caa aaa aaa cca tct aaa act gaa      676
Asn Thr Arg Leu Val Phe Asp Leu Gln Lys Lys Pro Ser Lys Thr Glu
200                 205                 210                 215

att aaa caa tta gat aca aat aaa att gaa atc caa att cattaaattg      725
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            20                  25                  30
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Tyr Gln Glu Asp Gly Gln Met Val Thr Gly Ile Ile Ser Lys Ile Ile
35 40 45

Gly Ser Asn Cys Asp Asn Ser Ser Thr Ser Asp Ile Asn Asn Lys Lys
50 55 60

Ser Ile Asp Arg Asp Lys Asp Thr Leu Leu Ser Ser Ser Asn Arg Asn
65 70 75 80

Thr Ile Gln Ala Gly Thr Pro His Gln Glu Asn Asn Ile Lys Glu Asp
85 90 95

Leu Gln Leu Thr Asn Lys Asn Glu Gln Thr Thr Pro Glu Glu Glu Glu
100 105 110

Glu Ser Lys Phe Ile Trp Leu Thr Glu Ala Pro Ser Glu Leu Lys Lys
115 120 125

Gly Glu Lys Ala Ile Thr Gln Thr Arg Leu Ser Ile Gly Lys Asp Ile
130 135 140

Ser Phe Arg Ile Thr Ala Asp Asp Ala Ile Lys Ala Gln Ser Met Met
145 150 155 160

Leu Lys Asn Pro Asp Arg Phe Val Leu Asp Leu Gln Gly Lys Trp Gly
165 170 175

Ile Ser Leu Pro Pro Ile Pro Pro Thr Asn Pro Trp Leu Lys Lys Ile
180 185 190

Arg Leu Gly Thr Asn Asn Gly Asn Thr Arg Leu Val Phe Asp Leu Gln
195 200 205

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Glu Ile Gln Ile
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Val Ala Leu Cys Ile Met Phe Ile Ile Met Val Gln Val Leu Gln Ala
        10                  15                  20

aat gca gct agc tat gtg gtt ttg cca ttt aaa gta aat gct cct cca     150
Asn Ala Ala Ser Tyr Val Val Leu Pro Phe Lys Val Asn Ala Pro Pro
    25                  30                  35

agc tat act tat ttg gaa aaa gct atc cca tct atg tta act tct aga     198
Ser Tyr Thr Tyr Leu Glu Lys Ala Ile Pro Ser Met Leu Thr Ser Arg
40                  45                  50                  55

ctt tat tgg gaa gaa cgt ttt caa cct atc ccg gat gct aat gct att     246
Leu Tyr Trp Glu Glu Arg Phe Gln Pro Ile Pro Asp Ala Asn Ala Ile
                60                  65                  70

aaa gca gga aag gta gaa gat ata aag gaa atg gat aag gca agg ata     294
Lys Ala Gly Lys Val Glu Asp Ile Lys Glu Met Asp Lys Ala Arg Ile
            75                  80                  85

gct aca ggt gca gac tat ctt ata tgg gga cag gta aat att gta ggt     342
Ala Thr Gly Ala Asp Tyr Leu Ile Trp Gly Gln Val Asn Ile Val Gly
        90                  95                  100

gat gaa gct acg ctt gat gta caa gtt tgt gat ata gaa gga tca att     390
Asp Glu Ala Thr Leu Asp Val Gln Val Cys Asp Ile Glu Gly Ser Ile
    105                 110                 115

tgg agg aaa agt aaa aat aca aaa gtt gat aat tta att act gcc ctt     438
Trp Arg Lys Ser Lys Asn Thr Lys Val Asp Asn Leu Ile Thr Ala Leu
120                 125                 130                 135

caa gat aca gca gat gca att aat agt gag ttg ttt ggg cgt gca act     486
Gln Asp Thr Ala Asp Ala Ile Asn Ser Glu Leu Phe Gly Arg Ala Thr
                140                 145                 150

aca aaa cca tca tca aaa gct act att gta gct caa atg aac tct gga     534
Thr Lys Pro Ser Ser Lys Ala Thr Ile Val Ala Gln Met Asn Ser Gly
            155                 160                 165

ttg att aag gga aaa gga aat gaa aat cag tca tat ctt aat cca gaa     582
Leu Ile Lys Gly Lys Gly Asn Glu Asn Gln Ser Tyr Leu Asn Pro Glu
        170                 175                 180

ttt cgt tat caa gga agc aat ctt tcc cgt ggc cga agt caa gct ctt     630
Phe Arg Tyr Gln Gly Ser Asn Leu Ser Arg Gly Arg Ser Gln Ala Leu
    185                 190                 195

ccc ttt gct tca gtt ggt ata gtt gtt ggt gac ttt ata gga gat aat     678
Pro Phe Ala Ser Val Gly Ile Val Val Gly Asp Phe Ile Gly Asp Asn
200                 205                 210                 215

aaa aat gaa gtt gcc ata tta agt gag tat aaa gtc cat att tat cga     726
Lys Asn Glu Val Ala Ile Leu Ser Glu Tyr Lys Val His Ile Tyr Arg
                220                 225                 230

tgg gaa gaa gaa agg tta gct ctt ctt gga gaa tat aaa ttc cct cgc     774
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Trp Glu Glu Glu Arg Leu Ala Leu Leu Gly Glu Tyr Lys Phe Pro Arg
            235                 240                 245

tca cta cag tct tta cat att cgt gct ttt gat gtg gat cat gat ggt      822
Ser Leu Gln Ser Leu His Ile Arg Ala Phe Asp Val Asp His Asp Gly
        250                 255                 260

gta cag gaa atc att gtt tct tgc ttt gat cct tca tat gca aag cca      870
Val Gln Glu Ile Ile Val Ser Cys Phe Asp Pro Ser Tyr Ala Lys Pro
    265                 270                 275

tat tcg ttt att ctt agt ttt aaa aat aga gtg ttt aaa gag tta gcc      918
Tyr Ser Phe Ile Leu Ser Phe Lys Asn Arg Val Phe Lys Glu Leu Ala
280                 285                 290                 295

aca aac tta cca ttt tat tta aat gtg gtt aaa ctt cca cca gat ttt      966
Thr Asn Leu Pro Phe Tyr Leu Asn Val Val Lys Leu Pro Pro Asp Phe
                300                 305                 310

tct cct atg tta att ggt caa aag agt gac aat tca agg att ttt tct     1014
Ser Pro Met Leu Ile Gly Gln Lys Ser Asp Asn Ser Arg Ile Phe Ser
            315                 320                 325

ccc tct ggg gtt tat gaa ata gaa aaa cat gga cgt aac tat ata atg     1062
Pro Ser Gly Val Tyr Glu Ile Glu Lys His Gly Arg Asn Tyr Ile Met
        330                 335                 340

gga aat cgt ctt agt ctt cca aag gaa gct aat att ttt aat ttt tct     1110
Gly Asn Arg Leu Ser Leu Pro Lys Glu Ala Asn Ile Phe Asn Phe Ser
    345                 350                 355

tgg tta cca tca gat tca tta aaa gat gaa gaa gct aag tta gta ctt     1158
Trp Leu Pro Ser Asp Ser Leu Lys Asp Glu Glu Ala Lys Leu Val Leu
360                 365                 370                 375

gta acc aat aat gaa aga tta gtt gta tat aat aca aaa ggt aca aga     1206
Val Thr Asn Asn Glu Arg Leu Val Val Tyr Asn Thr Lys Gly Thr Arg
                380                 385                 390

ctt ttt atg act gaa gaa gtg tat tat ggt tct tct gtt ggt ata gac     1254
Leu Phe Met Thr Glu Glu Val Tyr Tyr Gly Ser Ser Val Gly Ile Asp
            395                 400                 405

gag ccc agt aat atg cct ggt ctt gga aag tca aaa gag ctt atc cct     1302
Glu Pro Ser Asn Met Pro Gly Leu Gly Lys Ser Lys Glu Leu Ile Pro
        410                 415                 420

tct aaa tat ttt atc cca gga cgg atg att cct att aat ctt gat tca     1350
Ser Lys Tyr Phe Ile Pro Gly Arg Met Ile Pro Ile Asn Leu Asp Ser
    425                 430                 435

atg ggg aaa tgg gag ttg ctt gta agc aag cca att tct gtt gca gca     1398
Met Gly Lys Trp Glu Leu Leu Val Ser Lys Pro Ile Ser Val Ala Ala
440                 445                 450                 455

aaa ttt ttt gaa aat tat aga tct ttt gct gaa ggc gaa att cag gct     1446
Lys Phe Phe Glu Asn Tyr Arg Ser Phe Ala Glu Gly Glu Ile Gln Ala
                460                 465                 470

tta aca tgg gac ggc tta gga tta ggt ctt gta tgg aat aca cgt cgt     1494
Leu Thr Trp Asp Gly Leu Gly Leu Gly Leu Val Trp Asn Thr Arg Arg
            475                 480                 485
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att aag gga act att aca gat ttt gcc tta gct gat atg aat aat gat      1542
Ile Lys Gly Thr Ile Thr Asp Phe Ala Leu Ala Asp Met Asn Asn Asp
        490                 495                 500

ggg aag tta gac tta gtt gtt tcc gtt aat agc cat aca ggg att ctt      1590
Gly Lys Leu Asp Leu Val Val Ser Val Asn Ser His Thr Gly Ile Leu
    505                 510                 515

gga cta gaa aaa cga aag aca att ata gta ttt tat cct tta gag gta      1638
Gly Leu Glu Lys Arg Lys Thr Ile Ile Val Phe Tyr Pro Leu Glu Val
520                 525                 530                 535

gat aaa caa ggt atc cct aag gct gtt gaa gat aac taa ttttttccta      1687
Asp Lys Gln Gly Ile Pro Lys Ala Val Glu Asp Asn
                540                 545

ttaattattt ttttattctg atagttaa                                     1715
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<210> 6
<211> 547
<212> PRT
<213> Lawsonia intracellularis

<400> 6

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Met His Gln Lys Ser Cys Leu Val Ala Leu Cys Ile Met Phe Ile Ile
1               5                  10                  15

Met Val Gln Val Leu Gln Ala Asn Ala Ala Ser Tyr Val Val Leu Pro
            20                  25                  30

Phe Lys Val Asn Ala Pro Pro Ser Tyr Thr Tyr Leu Glu Lys Ala Ile
        35                  40                  45

Pro Ser Met Leu Thr Ser Arg Leu Tyr Trp Glu Glu Arg Phe Gln Pro
    50                  55                  60

Ile Pro Asp Ala Asn Ala Ile Lys Ala Gly Lys Val Glu Asp Ile Lys
65                  70                  75                  80

Glu Met Asp Lys Ala Arg Ile Ala Thr Gly Ala Asp Tyr Leu Ile Trp
                85                  90                  95

Gly Gln Val Asn Ile Val Gly Asp Glu Ala Thr Leu Asp Val Gln Val
            100                 105                 110

Cys Asp Ile Glu Gly Ser Ile Trp Arg Lys Ser Lys Asn Thr Lys Val
        115                 120                 125

Asp Asn Leu Ile Thr Ala Leu Gln Asp Thr Ala Asp Ala Ile Asn Ser
    130                 135                 140

Glu Leu Phe Gly Arg Ala Thr Thr Lys Pro Ser Ser Lys Ala Thr Ile
```

145 150 155 160

Val Ala Gln Met Asn Ser Gly Leu Ile Lys Gly Lys Gly Asn Glu Asn
165 170 175

Gln Ser Tyr Leu Asn Pro Glu Phe Arg Tyr Gln Gly Ser Asn Leu Ser
180 185 190

Arg Gly Arg Ser Gln Ala Leu Pro Phe Ala Ser Val Gly Ile Val Val
195 200 205

Gly Asp Phe Ile Gly Asp Asn Lys Asn Glu Val Ala Ile Leu Ser Glu
210 215 220

Tyr Lys Val His Ile Tyr Arg Trp Glu Glu Glu Arg Leu Ala Leu Leu
225 230 235 240

Gly Glu Tyr Lys Phe Pro Arg Ser Leu Gln Ser Leu His Ile Arg Ala
245 250 255

Phe Asp Val Asp His Asp Gly Val Gln Glu Ile Ile Val Ser Cys Phe
260 265 270

Asp Pro Ser Tyr Ala Lys Pro Tyr Ser Phe Ile Leu Ser Phe Lys Asn
275 280 285

Arg Val Phe Lys Glu Leu Ala Thr Asn Leu Pro Phe Tyr Leu Asn Val
290 295 300

Val Lys Leu Pro Pro Asp Phe Ser Pro Met Leu Ile Gly Gln Lys Ser
305 310 315 320

Asp Asn Ser Arg Ile Phe Ser Pro Ser Gly Val Tyr Glu Ile Glu Lys
325 330 335

His Gly Arg Asn Tyr Ile Met Gly Asn Arg Leu Ser Leu Pro Lys Glu
340 345 350

Ala Asn Ile Phe Asn Phe Ser Trp Leu Pro Ser Asp Ser Leu Lys Asp
355 360 365

Glu Glu Ala Lys Leu Val Leu Val Thr Asn Asn Glu Arg Leu Val Val
370 375 380

Tyr Asn Thr Lys Gly Thr Arg Leu Phe Met Thr Glu Glu Val Tyr Tyr
385 390 395 400

Gly Ser Ser Val Gly Ile Asp Glu Pro Ser Asn Met Pro Gly Leu Gly
405 410 415

Lys Ser Lys Glu Leu Ile Pro Ser Lys Tyr Phe Ile Pro Gly Arg Met
420 425 430

Ile Pro Ile Asn Leu Asp Ser Met Gly Lys Trp Glu Leu Leu Val Ser
435 440 445

Lys Pro Ile Ser Val Ala Ala Lys Phe Phe Glu Asn Tyr Arg Ser Phe
450 455 460

Ala Glu Gly Glu Ile Gln Ala Leu Thr Trp Asp Gly Leu Gly Leu Gly
465 470 475 480

Leu Val Trp Asn Thr Arg Arg Ile Lys Gly Thr Ile Thr Asp Phe Ala
485 490 495

Leu Ala Asp Met Asn Asn Asp Gly Lys Leu Asp Leu Val Val Ser Val
500 505 510

Asn Ser His Thr Gly Ile Leu Gly Leu Glu Lys Arg Lys Thr Ile Ile
515 520 525

Val Phe Tyr Pro Leu Glu Val Asp Lys Gln Gly Ile Pro Lys Ala Val
530 535 540

Glu Asp Asn
545

<210> 7
<211> 1564
<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (41)..(1522)

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Met Val Ser Tyr Ile
1 5

cgt tta tta gga agt ata ttt tta gta tta gca att ttt ggt tgt ggc 103
Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala Ile Phe Gly Cys Gly
10 15 20

gct cag ttt aat aaa ccc tct tta ctt gat gaa acc cct ata gat tac 151
Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu Thr Pro Ile Asp Tyr
25 30 35

```
agt tct gta ctt tct gat tac ata gta gaa tta gaa aaa gaa cca ctt      199
Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu Glu Lys Glu Pro Leu
        40                  45                  50

cag tat ata tta cta aaa aaa gaa aaa ttt tct caa atg gag ata tat      247
Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser Gln Met Glu Ile Tyr
    55                  60                  65

aat tat caa ttc aca tca caa cat tgg tct cca gat aat ttt gta tca      295
Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro Asp Asn Phe Val Ser
70                  75                  80                  85

cct gct ata tgg gaa cat cag gta gat ata tat atc cct cac cat cca      343
Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr Ile Pro His His Pro
                90                  95                  100

gtt tca gaa cgt gca ctt ctt atc atc aat aat ggt att aat aat ggt      391
Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn Gly Ile Asn Asn Gly
            105                 110                 115

aca ttt ttt act tct cct aaa gct cca act gat ttt act cca gaa gta      439
Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp Phe Thr Pro Glu Val
        120                 125                 130

tta gaa gaa atc gct cgt tca aca aaa act gta gtc att gct cta agt      487
Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val Val Ile Ala Leu Ser
    135                 140                 145

gat atc cca aat cag tat ctt act tat aga ggt gac tgg aga ttt ctt      535
Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly Asp Trp Arg Phe Leu
150                 155                 160                 165

aag gaa gat gaa agt att gct atg agt tgg tct agt ttt tta caa gat      583
Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser Ser Phe Leu Gln Asp
                170                 175                 180

cca gaa agt cgg tac aca aga cct ctc tat gtc cct atg gtt gca gca      631
Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val Pro Met Val Ala Ala
            185                 190                 195

gtt tct cag gca atg act ctt gca gaa aag gag tta caa gca tta aaa      679
Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu Leu Gln Ala Leu Lys
        200                 205                 210

att aag cat ttt att gta tct ggt gtg tca aag cgt gga tgg aca aca      727
Ile Lys His Phe Ile Val Ser Gly Val Ser Lys Arg Gly Trp Thr Thr
    215                 220                 225

tgg ctt tca gct att gct gac tca cga gta gat gct att acc ccg ttt      775
Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp Ala Ile Thr Pro Phe
230                 235                 240                 245

gtt att gat gca ttg aat act cgg aaa gtc ctt gga cat atg tat aaa      823
Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu Gly His Met Tyr Lys
                250                 255                 260

aca tat gga aat aat tgg cct ata gca ttt tat cca tat tat aga ttt      871
Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr Pro Tyr Tyr Arg Phe
            265                 270                 275

gat tta gat aaa caa cta gat aca gtt cct ttt ttc aat ctt atg aat      919
Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe Phe Asn Leu Met Asn
        280                 285                 290
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att gtt gat cca tat aga tat tta gga aca cca tat aag tct cga ctt      967
Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro Tyr Lys Ser Arg Leu
    295                 300                 305

gct atc cct aaa tat att gta aat gca agt gga gat gat ttt tat gtc     1015
Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly Asp Asp Phe Tyr Val
310                 315                 320                 325

cct gat aat tca agt ttt tac tat gat gat ctc cct gga gag aaa gca     1063
Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu Pro Gly Glu Lys Ala
                330                 335                 340

tta cgt ttt gca cca aac tca aat cat cat ggg ata tta aat ttc aca     1111
Leu Arg Phe Ala Pro Asn Ser Asn His His Gly Ile Leu Asn Phe Thr
            345                 350                 355

aaa caa tcg ctt att cct ttt gtg aat aga gta caa aaa ggt att tca     1159
Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val Gln Lys Gly Ile Ser
        360                 365                 370

acg cca gtt tta gat att tcc aca gag atg acg gaa cga gtt caa tat     1207
Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr Glu Arg Val Gln Tyr
    375                 380                 385

gtg act gtt cgt ttt tct gaa gtt cca gag aag ata gta ctt tgg aaa     1255
Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys Ile Val Leu Trp Lys
390                 395                 400                 405

gca gca aat cca gag tca cga gat ttt cgt tat gcc tgt cgt gtt agg     1303
Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr Ala Cys Arg Val Arg
                410                 415                 420

tac atg gaa aca cca tta cac ctt tct gca aca ggg gaa gtt agc gtt     1351
Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr Gly Glu Val Ser Val
            425                 430                 435

tca tta gag atc cct tct gta gga tgg caa gct gct ttt att gaa gct     1399
Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala Ala Phe Ile Glu Ala
        440                 445                 450

aca ttt aaa gat ggt ttt gtt gca aca aca cca gtg tat att tta cca     1447
Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro Val Tyr Ile Leu Pro
    455                 460                 465

aaa gat ata tat cca cct ata aaa ata cca cct gta cat gga tta tta     1495
Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro Val His Gly Leu Leu
470                 475                 480                 485

tgt aag ttt gta cat ggt cga acc tag taactagtag ttgttgtact           1542
Cys Lys Phe Val His Gly Arg Thr
                490

gataatctaa aaggatatag at                                           1564
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<210> 8
<211> 493
<212> PRT
<213> Lawsonia intracellularis

<400> 8

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Met Val Ser Tyr Ile Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala
1               5                  10                  15

Ile Phe Gly Cys Gly Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu
            20                  25                  30

Thr Pro Ile Asp Tyr Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu
        35                  40                  45

Glu Lys Glu Pro Leu Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser
    50                  55                  60

Gln Met Glu Ile Tyr Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro
65                  70                  75                  80

Asp Asn Phe Val Ser Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr
                85                  90                  95

Ile Pro His His Pro Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn
            100                 105                 110

Gly Ile Asn Asn Gly Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp
        115                 120                 125

Phe Thr Pro Glu Val Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val
    130                 135                 140

Val Ile Ala Leu Ser Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly
145                 150                 155                 160

Asp Trp Arg Phe Leu Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser
                165                 170                 175

Ser Phe Leu Gln Asp Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val
            180                 185                 190

Pro Met Val Ala Ala Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu
        195                 200                 205

Leu Gln Ala Leu Lys Ile Lys His Phe Ile Val Ser Gly Val Ser Lys
    210                 215                 220

Arg Gly Trp Thr Thr Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp
225                 230                 235                 240

Ala Ile Thr Pro Phe Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu
                245                 250                 255
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Gly His Met Tyr Lys Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr
260 265 270

Pro Tyr Tyr Arg Phe Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe
275 280 285

Phe Asn Leu Met Asn Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro
290 295 300

Tyr Lys Ser Arg Leu Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly
305 310 315 320

Asp Asp Phe Tyr Val Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu
325 330 335

Pro Gly Glu Lys Ala Leu Arg Phe Ala Pro Asn Ser Asn His His Gly
340 345 350

Ile Leu Asn Phe Thr Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val
355 360 365

Gln Lys Gly Ile Ser Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr
370 375 380

Glu Arg Val Gln Tyr Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys
385 390 395 400

Ile Val Leu Trp Lys Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr
405 410 415

Ala Cys Arg Val Arg Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr
420 425 430

Gly Glu Val Ser Val Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala
435 440 445

Ala Phe Ile Glu Ala Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro
450 455 460

Val Tyr Ile Leu Pro Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro
465 470 475 480

Val His Gly Leu Leu Cys Lys Phe Val His Gly Arg Thr
485 490

<210> 9
<211> 2096

<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (12)..(2096)

<400> 9

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aggacaaaac t atg gcg gat tat ctt tca gga gga att tct ttt gga gga       50
             Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly
             1               5                   10

att ggt agt gga acc gat ttc caa gct atg att gat caa ctt aag aaa       98
Ile Gly Ser Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys
    15                  20                  25

att gag ctt att cct aaa aat aga ctt gta gtt tcc cat gaa caa tgg      146
Ile Glu Leu Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp
30                  35                  40                  45

aca aaa aaa tat aaa gca ttt gaa gag ctt ata aaa aca gtt aaa gat      194
Thr Lys Lys Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp
                50                  55                  60

act gaa gcg tct tta agt aag cta agt tct gtt ggt gct att tta aaa      242
Thr Glu Ala Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys
            65                  70                  75

aaa gaa ggt tct gtt tca aat act tct gtt gca agc gtt aag gca agt      290
Lys Glu Gly Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser
        80                  85                  90

tct gat gca tct gat gga aca cat aca att gat gtg aaa cag ctt gca      338
Ser Asp Ala Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala
    95                  100                 105

aca aac acg att ctt tct aat aat cat att ttt gat tct aaa act gaa      386
Thr Asn Thr Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu
110                 115                 120                 125

agt att aat aat aca ggt tca cct ggt atc ttt gct tat gag tat aaa      434
Ser Ile Asn Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys
                130                 135                 140

ggg gaa cta cat gaa gtt gaa gtt cct cca ggt agt gat ctt gaa tat      482
Gly Glu Leu His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr
            145                 150                 155

ctt gca aca tta ata aac aaa gat tct aat aat cct ggt gtt aaa gca      530
Leu Ala Thr Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala
        160                 165                 170

aac ctt atc aag act ggc gat ggc tat atg ttt agt ctt gaa gga act      578
Asn Leu Ile Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr
    175                 180                 185

gaa act ggt gca aat gcg act tta tct att tca aat aag aca acg ctt      626
Glu Thr Gly Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu
190                 195                 200                 205

cca gac ttt aaa gca tct gtt gct acc agc agt gca tta gct aat ggt      674
Pro Asp Phe Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly
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                    210                 215                 220

gaa gat aca att att aat act tca gga aca act caa caa ttt tct ttt      722
Glu Asp Thr Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe
            225                 230                 235

gaa tac aat gga aga aca ttt act ttc gat att cct tca gga aca aca      770
Glu Tyr Asn Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr
        240                 245                 250

gca aaa gaa ctc caa aca gct ata aat gaa aat aca aaa aat aca gga      818
Ala Lys Glu Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly
    255                 260                 265

gta cgt gca act ttt gaa aaa cat ggc tca gat ata gta ttg caa tta      866
Val Arg Ala Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu
270                 275                 280                 285

gaa gga aca gtt cct aat caa caa gtt aaa gta acc gct agc cct act      914
Glu Gly Thr Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr
                290                 295                 300

gat ctt gga agt ttc aca tct tcg ggt caa gca ggc tgg aat aaa cgt      962
Asp Leu Gly Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg
            305                 310                 315

gat tct caa gat gct att ttt aat att aat ggt tgg gac caa gaa ctt     1010
Asp Ser Gln Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu
        320                 325                 330

aca tct tct aca aat gaa ctt aca gaa gtt atc cca gga ctt caa att     1058
Thr Ser Ser Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile
    335                 340                 345

aca cta ctt tcc gaa ggg aaa aca caa att aca att cag act tct act     1106
Thr Leu Leu Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr
350                 355                 360                 365

gac gaa gta aaa aaa caa gtt gag aaa gca gta gag tct ata aat aat     1154
Asp Glu Val Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn
                370                 375                 380

gtt ctt tcc aaa att caa gag tta act aaa gca aca gct gaa gac aaa     1202
Val Leu Ser Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys
            385                 390                 395

gat gat agt aaa gac act tct agt tct tca agt aaa att cca tca tat     1250
Asp Asp Ser Lys Asp Thr Ser Ser Ser Ser Ser Lys Ile Pro Ser Tyr
        400                 405                 410

tta caa agt cct aca aaa gtg aag gct gga cta ttt aca ggt gat act     1298
Leu Gln Ser Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr
    415                 420                 425

ggc ata caa atg ctt agt act aga ctt aag tct atc ttt tct tct aat     1346
Gly Ile Gln Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn
430                 435                 440                 445

ggt cta ggt ttt tct cct aaa caa aca caa gat ggt cca ggg gat cta     1394
Gly Leu Gly Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu
                450                 455                 460

ttt tca tca ctt gct tca att ggt att gtc gta gat gct gat gag ggt     1442
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Phe Ser Ser Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly
            465                 470                 475

agt gaa act ttt gga caa ctt aaa att tta gat aga gaa aca att ggt     1490
Ser Glu Thr Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly
        480                 485                 490

cct gat gca cct tat aca act ctt gat gag gca tta aaa aaa gat cca     1538
Pro Asp Ala Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro
    495                 500                 505

caa gca gta gca gat ata tta gct ggt agt tct gga ata tct gat tca     1586
Gln Ala Val Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser
510                 515                 520                 525

aca gat ttt tct tat caa gat cat att gtt gga aaa aca caa gct ggt     1634
Thr Asp Phe Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly
                530                 535                 540

aca tat gat gta aag tat tct gta gat gca agt ggt act ata gga gac     1682
Thr Tyr Asp Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp
            545                 550                 555

gtt tac att gga ggt gta aaa gct tct cta tct gat cct gca aaa aat     1730
Val Tyr Ile Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn
        560                 565                 570

ata tat acg gtc aca tct ggt cct gct aca ggt ctt agt ata gca gtt     1778
Ile Tyr Thr Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val
    575                 580                 585

aat aat cgt act cca ggt atc aat gta gaa agt act gta aga gtc aaa     1826
Asn Asn Arg Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys
590                 595                 600                 605

caa ggt aaa ctt agc caa ata caa gaa gca ctt aaa gct gaa gta cag     1874
Gln Gly Lys Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln
                610                 615                 620

caa gat cct tta aaa gaa aac aca ggt cct tta att atc atg caa gat     1922
Gln Asp Pro Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp
            625                 630                 635

aac tat aag gat gtt atg aaa aat ctt gag aca aga ata gaa aaa gaa     1970
Asn Tyr Lys Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu
        640                 645                 650

aca caa aga gtt act agt tgg gaa cgt atg atg cgt tta aaa ttt tct     2018
Thr Gln Arg Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser
    655                 660                 665

aga ctt gat gct gta tta gca aaa tat aat cag atg atg tca gca aat     2066
Arg Leu Asp Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn
670                 675                 680                 685

gct tct agt tta ggg caa ctt ggt gca taa                            2096
Ala Ser Ser Leu Gly Gln Leu Gly Ala
                690
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<210> 10
<211> 694
<212> PRT

<213> Lawsonia intracellularis

<400> 10

Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly Ile Gly Ser
1 5 10 15

Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys Ile Glu Leu
20 25 30

Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp Thr Lys Lys
35 40 45

Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp Thr Glu Ala
50 55 60

Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys Lys Glu Gly
65 70 75 80

Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser Ser Asp Ala
85 90 95

Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala Thr Asn Thr
100 105 110

Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu Ser Ile Asn
115 120 125

Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys Gly Glu Leu
130 135 140

His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr Leu Ala Thr
145 150 155 160

Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala Asn Leu Ile
165 170 175

Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr Glu Thr Gly
180 185 190

Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu Pro Asp Phe
195 200 205

Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly Glu Asp Thr
210 215 220

Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe Glu Tyr Asn
225 230 235 240

Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr Ala Lys Glu
245 250 255

Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly Val Arg Ala
260 265 270

Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu Glu Gly Thr
275 280 285

Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr Asp Leu Gly
290 295 300

Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg Asp Ser Gln
305 310 315 320

Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu Thr Ser Ser
325 330 335

Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile Thr Leu Leu
340 345 350

Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr Asp Glu Val
355 360 365

Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn Val Leu Ser
370 375 380

Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys Asp Asp Ser
385 390 395 400

Lys Asp Thr Ser Ser Ser Ser Ser Lys Ile Pro Ser Tyr Leu Gln Ser
405 410 415

Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr Gly Ile Gln
420 425 430

Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn Gly Leu Gly
435 440 445

Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu Phe Ser Ser
450 455 460

Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly Ser Glu Thr
465 470 475 480

Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly Pro Asp Ala
485 490 495

Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro Gln Ala Val
500 505 510

Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser Thr Asp Phe
515 520 525

Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly Thr Tyr Asp
530 535 540

Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp Val Tyr Ile
545 550 555 560

Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn Ile Tyr Thr
565 570 575

Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val Asn Asn Arg
580 585 590

Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys Gln Gly Lys
595 600 605

Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln Gln Asp Pro
610 615 620

Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp Asn Tyr Lys
625 630 635 640

Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu Thr Gln Arg
645 650 655

Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser Arg Leu Asp
660 665 670

Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn Ala Ser Ser
675 680 685

Leu Gly Gln Leu Gly Ala
690

<210> 11
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<213> Lawsonia intracellularis

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<222> (13)..(1200)

<400> 11

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taggagatag tt atg gct aat gtt agt gga atc cct gca cca cga tta ctt      51
              Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu
              1               5                  10

tcc aca aca aat caa atg acc aat gca gct gct ggt aat act aat aga       99
Ser Thr Thr Asn Gln Met Thr Asn Ala Ala Ala Gly Asn Thr Asn Arg
    15                  20                  25

gct acc ggt agt atg aac ggt cgt aat ctc aca caa ata aaa aca cct      147
Ala Thr Gly Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro
30                  35                  40                  45

cag tcc atg att gat aat gct tca gaa gaa tta aca act tct ctt gaa      195
Gln Ser Met Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu
                50                  55                  60

tct aaa agc agt gac gac ttt gca att aaa gat cgt aaa aga caa ggg      243
Ser Lys Ser Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly
            65                  70                  75

aaa gga tct gat tct cta tta aaa atg gtt caa gaa tat aca gag ctg      291
Lys Gly Ser Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu
        80                  85                  90

acg aat gat gat acc cgt aat gct aaa aga gct atg tta tcc cag gta      339
Thr Asn Asp Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val
    95                  100                 105

tta cgt gca agt caa agt tca caa gat gta ctc gaa aaa aca tta gaa      387
Leu Arg Ala Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu
110                 115                 120                 125

caa ttt tct aat aaa aca gat gct tgg gct tct ctt gca gaa att gca      435
Gln Phe Ser Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala
                130                 135                 140

caa gaa tat ggt gca gaa tct cca cag cca aca gga tta aaa tct gta      483
Gln Glu Tyr Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val
            145                 150                 155

tta gat gct atg gag aca tta gaa aat gag ttt ggt gat gaa att aaa      531
Leu Asp Ala Met Glu Thr Leu Glu Asn Glu Phe Gly Asp Glu Ile Lys
        160                 165                 170

gca gga cta aaa gga gct cta aat tca aaa gaa ttt act gat ata ggc      579
Ala Gly Leu Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly
    175                 180                 185

agt gca gca cag tta aga gat ctt tat aca aca aca gta act ata aca      627
Ser Ala Ala Gln Leu Arg Asp Leu Tyr Thr Thr Thr Val Thr Ile Thr
190                 195                 200                 205

gct gca cct gat gca gtg tta gca aga ctt ctt gaa gaa tat gag agt      675
Ala Ala Pro Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser
                210                 215                 220

gat gat gat ctg gat aga gcc att gat ttc ctt cta tct aca ctt ggt      723
Asp Asp Asp Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly
            225                 230                 235

gga gag ctt gaa tca gct gat cca agt atg gat aaa gta cat ctt caa      771
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Gly Glu Leu Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln
        240                 245                 250

agt gta atg ggt gat att gaa aaa aca caa caa ctt cat agc tct cat      819
Ser Val Met Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His
    255                 260                 265

aaa caa tgt act aca gcc ctt agc agg tgg aaa gag aaa cat aaa ggt      867
Lys Gln Cys Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly
270                 275                 280                 285

ggg ggg gaa aat agt aca cta act cct tta gaa atg atg cgt gaa cta      915
Gly Gly Glu Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu
                290                 295                 300

att gca cta aaa aat gaa aat ttt att tct cct tcc tct ata gat aaa      963
Ile Ala Leu Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys
            305                 310                 315

att gtt gat caa gct gat ccc caa gat att gaa aaa gaa gtc ctt ttt     1011
Ile Val Asp Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe
        320                 325                 330

tta caa gag atg tta gct gct gta aga aaa ttt ccc att atg gta ttt     1059
Leu Gln Glu Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe
    335                 340                 345

gat aat gtc gaa aat cgt gta aga gtt atg ggt gct gta caa gat gct     1107
Asp Asn Val Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala
350                 355                 360                 365

gtt gac gat gct gta aga aga gaa gat gaa ttc ctc ttt caa aaa gaa     1155
Val Asp Asp Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu
                370                 375                 380

cat cct gat gta cca cta caa cca gat gaa aat aat ata caa taa         1200
His Pro Asp Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln
            385                 390                 395
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<210> 12
<211> 395
<212> PRT
<213> Lawsonia intracellularis

<400> 12

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Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu Ser Thr Thr
1               5                   10                  15

Asn Gln Met Thr Asn Ala Ala Ala Gly Asn Thr Asn Arg Ala Thr Gly
            20                  25                  30

Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro Gln Ser Met
        35                  40                  45

Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu Ser Lys Ser
    50                  55                  60
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Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly Lys Gly Ser
65 70 75 80

Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu Thr Asn Asp
85 90 95

Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val Leu Arg Ala
100 105 110

Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu Gln Phe Ser
115 120 125

Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala Gln Glu Tyr
130 135 140

Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val Leu Asp Ala
145 150 155 160

Met Glu Thr Leu Glu Asn Glu Phe Gly Asp Glu Ile Lys Ala Gly Leu
165 170 175

Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly Ser Ala Ala
180 185 190

Gln Leu Arg Asp Leu Tyr Thr Thr Thr Val Thr Ile Thr Ala Ala Pro
195 200 205

Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser Asp Asp Asp
210 215 220

Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly Gly Glu Leu
225 230 235 240

Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln Ser Val Met
245 250 255

Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His Lys Gln Cys
260 265 270

Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly Gly Gly Glu
275 280 285

Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu Ile Ala Leu
290 295 300

Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys Ile Val Asp
305 310 315 320

Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe Leu Gln Glu
325 330 335

Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe Asp Asn Val
340 345 350

Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala Val Asp Asp
355 360 365

Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu His Pro Asp
370 375 380

Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln
385 390 395

<210> 13
<211> 1269
<212> DNA
<213> Lawsonia intracellularis

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<221> CDS
<222> (32)..(1222)

<400> 13
tgttggaaat tctctctgga ggagtaaagc a atg aca aat ttt gga gat ata 52
Met Thr Asn Phe Gly Asp Ile
1 5

agc gga agc tcc gca aga atg agt agc ttg atg act ggt aca tcc ggt 100
Ser Gly Ser Ser Ala Arg Met Ser Ser Leu Met Thr Gly Thr Ser Gly
10 15 20

gaa gaa gga ctt gaa gaa ctt gaa ggt ggt gtt cct aaa gag caa ggt 148
Glu Glu Gly Leu Glu Glu Leu Glu Gly Gly Val Pro Lys Glu Gln Gly
25 30 35

ggt cca ggt aaa gga gat gct tca gag gct gct aaa ggt caa gca gca 196
Gly Pro Gly Lys Gly Asp Ala Ser Glu Ala Ala Lys Gly Gln Ala Ala
40 45 50 55

gca gat agt att aat tca gct ggt ggt act gaa aag cct gga gaa gtt 244
Ala Asp Ser Ile Asn Ser Ala Gly Gly Thr Glu Lys Pro Gly Glu Val
60 65 70

ggt gat aag gaa gat gta ggg gaa ggt ggc gaa ata cct gaa ggt ggt 292
Gly Asp Lys Glu Asp Val Gly Glu Gly Gly Glu Ile Pro Glu Gly Gly
75 80 85

gaa ata cct gag ggt ggt gaa gaa gtt cca gag gaa ccc cca tat gtc 340
Glu Ile Pro Glu Gly Gly Glu Glu Val Pro Glu Glu Pro Pro Tyr Val
90 95 100

cct cct cca ttg gtt gaa cca gct aaa atc agt aca gta aca gat ctc 388
Pro Pro Pro Leu Val Glu Pro Ala Lys Ile Ser Thr Val Thr Asp Leu
105 110 115

```
agt acg tta atg gga tca cta cag ctg aca gag caa aaa aag aat gct      436
Ser Thr Leu Met Gly Ser Leu Gln Leu Thr Glu Gln Lys Lys Asn Ala
120                 125                 130                 135

gaa aaa aca gta aat gaa att aaa gca cag aat aaa gag caa caa gta      484
Glu Lys Thr Val Asn Glu Ile Lys Ala Gln Asn Lys Glu Gln Gln Val
                140                 145                 150

aag ttc caa gag caa att aaa aag att gag gat aat att gct gaa tct      532
Lys Phe Gln Glu Gln Ile Lys Lys Ile Glu Asp Asn Ile Ala Glu Ser
            155                 160                 165

aag aaa agt ggt ata ctt aag ttt ttc caa aag ttg ttt gca gtt att      580
Lys Lys Ser Gly Ile Leu Lys Phe Phe Gln Lys Leu Phe Ala Val Ile
        170                 175                 180

ggt gct gta cta gga gct att gga ggt gcg cta gct att gct gca ggt      628
Gly Ala Val Leu Gly Ala Ile Gly Gly Ala Leu Ala Ile Ala Ala Gly
    185                 190                 195

gct gct tca ggt aac cca tta ttg gtt gct gca ggt att atg gct att      676
Ala Ala Ser Gly Asn Pro Leu Leu Val Ala Ala Gly Ile Met Ala Ile
200                 205                 210                 215

gta gct tca att gat gca gca atg tcg tcg cta tcg gat ggt aaa gtg      724
Val Ala Ser Ile Asp Ala Ala Met Ser Ser Leu Ser Asp Gly Lys Val
                220                 225                 230

tcc atc tca gca ggg att agt aag gct ctt gag gct atg gga gta cca      772
Ser Ile Ser Ala Gly Ile Ser Lys Ala Leu Glu Ala Met Gly Val Pro
            235                 240                 245

gca gaa aca gca caa tgg att gca ttt ggt ata cag tta gca atg att      820
Ala Glu Thr Ala Gln Trp Ile Ala Phe Gly Ile Gln Leu Ala Met Ile
        250                 255                 260

gca gtg act ata gct att ggt ttt gcc tct ggt ggt ggt gga gca atg      868
Ala Val Thr Ile Ala Ile Gly Phe Ala Ser Gly Gly Gly Gly Ala Met
    265                 270                 275

gct gga gtg tca aaa ata gca gat atg ttt tca aag tct caa gat gta      916
Ala Gly Val Ser Lys Ile Ala Asp Met Phe Ser Lys Ser Gln Asp Val
280                 285                 290                 295

gct aag ttg gca cag atg att gaa aaa gct tct aaa ata gta caa atc      964
Ala Lys Leu Ala Gln Met Ile Glu Lys Ala Ser Lys Ile Val Gln Ile
                300                 305                 310

gct ggt tca gtt aat cag tct gct ata ggc ggt aca ggt att ggt aca     1012
Ala Gly Ser Val Asn Gln Ser Ala Ile Gly Gly Thr Gly Ile Gly Thr
            315                 320                 325

gct gta gtg caa agc aat ata aaa gct aat gaa tct gaa caa aaa gaa     1060
Ala Val Val Gln Ser Asn Ile Lys Ala Asn Glu Ser Glu Gln Lys Glu
        330                 335                 340

att gaa gct gct att gca aaa gtt aaa gct aag ata gag acg tta caa     1108
Ile Glu Ala Ala Ile Ala Lys Val Lys Ala Lys Ile Glu Thr Leu Gln
    345                 350                 355

gac ttc ttt aaa aac caa atg gaa caa ttc aat gct ata atg aaa ata     1156
Asp Phe Phe Lys Asn Gln Met Glu Gln Phe Asn Ala Ile Met Lys Ile
```

360 365 370 375

ata aca gat att att caa gat agc gtc aat aca aaa ata gct gtt caa 1204
Ile Thr Asp Ile Ile Gln Asp Ser Val Asn Thr Lys Ile Ala Val Gln
380 385 390

cgt ggt gca cgt gag taa tacctttagt aaatacagtg actatactat 1252
Arg Gly Ala Arg Glu
395

aatatataaa ttaataa 1269

<210> 14
<211> 396
<212> PRT
<213> Lawsonia intracellularis

<400> 14

Met Thr Asn Phe Gly Asp Ile Ser Gly Ser Ser Ala Arg Met Ser Ser
1 5 10 15

Leu Met Thr Gly Thr Ser Gly Glu Glu Gly Leu Glu Glu Leu Glu Gly
20 25 30

Gly Val Pro Lys Glu Gln Gly Gly Pro Gly Lys Gly Asp Ala Ser Glu
35 40 45

Ala Ala Lys Gly Gln Ala Ala Ala Asp Ser Ile Asn Ser Ala Gly Gly
50 55 60

Thr Glu Lys Pro Gly Glu Val Gly Asp Lys Glu Asp Val Gly Glu Gly
65 70 75 80

Gly Glu Ile Pro Glu Gly Gly Glu Ile Pro Glu Gly Gly Glu Glu Val
85 90 95

Pro Glu Glu Pro Pro Tyr Val Pro Pro Pro Leu Val Glu Pro Ala Lys
100 105 110

Ile Ser Thr Val Thr Asp Leu Ser Thr Leu Met Gly Ser Leu Gln Leu
115 120 125

Thr Glu Gln Lys Lys Asn Ala Glu Lys Thr Val Asn Glu Ile Lys Ala
130 135 140

Gln Asn Lys Glu Gln Gln Val Lys Phe Gln Glu Gln Ile Lys Lys Ile
145 150 155 160

Glu Asp Asn Ile Ala Glu Ser Lys Lys Ser Gly Ile Leu Lys Phe Phe
165 170 175

Gln Lys Leu Phe Ala Val Ile Gly Ala Val Leu Gly Ala Ile Gly Gly
180 185 190

Ala Leu Ala Ile Ala Ala Gly Ala Ala Ser Gly Asn Pro Leu Leu Val
195 200 205

Ala Ala Gly Ile Met Ala Ile Val Ala Ser Ile Asp Ala Ala Met Ser
210 215 220

Ser Leu Ser Asp Gly Lys Val Ser Ile Ser Ala Gly Ile Ser Lys Ala
225 230 235 240

Leu Glu Ala Met Gly Val Pro Ala Glu Thr Ala Gln Trp Ile Ala Phe
245 250 255

Gly Ile Gln Leu Ala Met Ile Ala Val Thr Ile Ala Ile Gly Phe Ala
260 265 270

Ser Gly Gly Gly Gly Ala Met Ala Gly Val Ser Lys Ile Ala Asp Met
275 280 285

Phe Ser Lys Ser Gln Asp Val Ala Lys Leu Ala Gln Met Ile Glu Lys
290 295 300

Ala Ser Lys Ile Val Gln Ile Ala Gly Ser Val Asn Gln Ser Ala Ile
305 310 315 320

Gly Gly Thr Gly Ile Gly Thr Ala Val Val Gln Ser Asn Ile Lys Ala
325 330 335

Asn Glu Ser Glu Gln Lys Glu Ile Glu Ala Ala Ile Ala Lys Val Lys
340 345 350

Ala Lys Ile Glu Thr Leu Gln Asp Phe Phe Lys Asn Gln Met Glu Gln
355 360 365

Phe Asn Ala Ile Met Lys Ile Ile Thr Asp Ile Ile Gln Asp Ser Val
370 375 380

Asn Thr Lys Ile Ala Val Gln Arg Gly Ala Arg Glu
385 390 395

<210> 15
<211> 894
<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (13)..(894)

<400> 15

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aggaggaatt at atg tct ctt gtc att aat aac aac ctg atg gcc gtc aat      51
             Met Ser Leu Val Ile Asn Asn Asn Leu Met Ala Val Asn
             1               5                   10

gct caa cgt aac tta agc aag tct tat gga gaa ctg agt tct tct gtt      99
Ala Gln Arg Asn Leu Ser Lys Ser Tyr Gly Glu Leu Ser Ser Ser Val
    15                  20                  25

cga aaa ctt tct tca ggt ctt cgt gta gga act gct gct gat gac tca     147
Arg Lys Leu Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser
30                  35                  40                  45

gca ggg tta gcc att cga gaa ctc atg aga tct gac att gca aca aca     195
Ala Gly Leu Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr
                50                  55                  60

caa caa gga ata cga aat gcg aat gat gct att tct atg att caa act     243
Gln Gln Gly Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr
            65                  70                  75

gcg gat ggt gca ctt gga gtc atc gat gaa aag ctc att cga atg aaa     291
Ala Asp Gly Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys
        80                  85                  90

gaa ctt gct gaa caa gct gct aca ggt aca tat aac tcc act cag cgt     339
Glu Leu Ala Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg
    95                  100                 105

atg att att gac tct gaa tat caa gct atg gcc tca gaa att act cgt     387
Met Ile Ile Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg
110                 115                 120                 125

att gct aat gcg aca gaa ttt aat ggt ata aaa ctt ctt gat ggt tca     435
Ile Ala Asn Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser
                130                 135                 140

tta tca ggt aat cat gat ggg aaa aaa ata aat tca act ggt gca gta     483
Leu Ser Gly Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val
            145                 150                 155

cgt atc cac ttt ggg aca tct aac agc tct gct gaa gat tac tat gat     531
Arg Ile His Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp
        160                 165                 170

att aaa att ggt ggc tct aca gct tct gca tta gga ctt ggt aat aca     579
Ile Lys Ile Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr
    175                 180                 185

gta aaa ggt gcg ggt gct aca gtc tct act caa gct gca gca caa aat     627
Val Lys Gly Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn
190                 195                 200                 205

gcc tta aaa gct ata gat aat gcc att gtt tca aaa gat aaa att cga     675
Ala Leu Lys Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg
                210                 215                 220

gca cac ctt ggt gga tta caa aat aga ctt gaa gct aca gtt gat aat     723
Ala His Leu Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn
```

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                225                 230                 235

tta agt ata caa aat gaa aac tta caa gct gct gaa tct cgt ata tct      771
Leu Ser Ile Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser
        240                 245                 250

gat ata gat gta agc caa gaa atg aca caa ttt gta cgt aac caa ata      819
Asp Ile Asp Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile
    255                 260                 265

ctt aca caa aca ggt gtt gct atg ctt tca caa gct aat tct cta cca      867
Leu Thr Gln Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro
270                 275                 280                 285

cgt atg gct cag caa ctt att ggc taa                                  894
Arg Met Ala Gln Gln Leu Ile Gly
                290
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<210> 16
<211> 293
<212> PRT
<213> Lawsonia intracellularis

<400> 16

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Met Ser Leu Val Ile Asn Asn Asn Leu Met Ala Val Asn Ala Gln Arg
1               5                  10                  15

Asn Leu Ser Lys Ser Tyr Gly Glu Leu Ser Ser Ser Val Arg Lys Leu
            20                  25                  30

Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser Ala Gly Leu
        35                  40                  45

Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr Gln Gln Gly
    50                  55                  60

Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr Ala Asp Gly
65                  70                  75                  80

Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys Glu Leu Ala
                85                  90                  95

Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg Met Ile Ile
            100                 105                 110

Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg Ile Ala Asn
        115                 120                 125

Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser Leu Ser Gly
    130                 135                 140

Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val Arg Ile His
```

145 150 155 160

Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp Ile Lys Ile
165 170 175

Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr Val Lys Gly
180 185 190

Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn Ala Leu Lys
195 200 205

Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg Ala His Leu
210 215 220

Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn Leu Ser Ile
225 230 235 240

Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser Asp Ile Asp
245 250 255

Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile Leu Thr Gln
260 265 270

Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro Arg Met Ala
275 280 285

Gln Gln Leu Ile Gly
290

<210> 17
<211> 2848
<212> DNA
<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (29)..(2848)

<400> 17
accttaacta aaaaataaaa agaatatt atg tat aat ata att aat aag cat 52
Met Tyr Asn Ile Ile Asn Lys His
1 5

caa atc ata aaa att tta tta ttt tcc tta tgt gtt ttc ttt ttt aca 100
Gln Ile Ile Lys Ile Leu Leu Phe Ser Leu Cys Val Phe Phe Phe Thr
10 15 20

ctt aca gaa aaa caa aaa att tat gct gca gac gtc ttt ttt gag ggc 148
Leu Thr Glu Lys Gln Lys Ile Tyr Ala Ala Asp Val Phe Phe Glu Gly
25 30 35 40

aga acc gaa acc tta atc aat gta aac aaa cca ttt gat tct ttt ttt 196

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Arg Thr Glu Thr Leu Ile Asn Val Asn Lys Pro Phe Asp Ser Phe Phe
                45                  50                  55

gga ggt tct gac tct aca ata gga acc ctt gaa aca gga cct act aat      244
Gly Gly Ser Asp Ser Thr Ile Gly Thr Leu Glu Thr Gly Pro Thr Asn
            60                  65                  70

ctt acc ttc aca aca gta gga gcc ttc cgc aat tct gtt ttc aga att      292
Leu Thr Phe Thr Thr Val Gly Ala Phe Arg Asn Ser Val Phe Arg Ile
        75                  80                  85

att ggt ggt ggt agg tct agt ttt aac aac cca aat aca gtt aaa ggc      340
Ile Gly Gly Gly Arg Ser Ser Phe Asn Asn Pro Asn Thr Val Lys Gly
    90                  95                  100

aat gtt act cta act gtt tat aat act gat gta gaa aga ata att ggt      388
Asn Val Thr Leu Thr Val Tyr Asn Thr Asp Val Glu Arg Ile Ile Gly
105                 110                 115                 120

gca ggt atc agc aat aga gga ctt gta acc gtt act ggc tca gta aat      436
Ala Gly Ile Ser Asn Arg Gly Leu Val Thr Val Thr Gly Ser Val Asn
                125                 130                 135

atg aag cta gaa aat gtt tct gtt act aga gga att tat ggt ggt gtc      484
Met Lys Leu Glu Asn Val Ser Val Thr Arg Gly Ile Tyr Gly Gly Val
            140                 145                 150

tat act caa aat gga cat gta cta ggc tct atc aac atg cat ttg aaa      532
Tyr Thr Gln Asn Gly His Val Leu Gly Ser Ile Asn Met His Leu Lys
        155                 160                 165

aac gtc caa act cca cta tta ata ggt tct gga gta agc aat gga cct      580
Asn Val Gln Thr Pro Leu Leu Ile Gly Ser Gly Val Ser Asn Gly Pro
    170                 175                 180

aat cgt att act gta aat gga gac ata aac att gat gtt gaa gac tct      628
Asn Arg Ile Thr Val Asn Gly Asp Ile Asn Ile Asp Val Glu Asp Ser
185                 190                 195                 200

agg att caa tat gta aac att aca gga gaa gta gat gca ggg ata aaa      676
Arg Ile Gln Tyr Val Asn Ile Thr Gly Glu Val Asp Ala Gly Ile Lys
                205                 210                 215

gga aat gct act cta act gta aaa aaa tct act gtt gag ctt ata aac      724
Gly Asn Ala Thr Leu Thr Val Lys Lys Ser Thr Val Glu Leu Ile Asn
            220                 225                 230

tct ggt aga ggt aat atc tta ggt aat ctc aaa ata tct ata gca gat      772
Ser Gly Arg Gly Asn Ile Leu Gly Asn Leu Lys Ile Ser Ile Ala Asp
        235                 240                 245

tca aat ata agg ggg tta tca cca gta gac ttt ggt tct tca gta tat      820
Ser Asn Ile Arg Gly Leu Ser Pro Val Asp Phe Gly Ser Ser Val Tyr
    250                 255                 260

ggg gac aca tct ata aat gta att aat tct cag att aat gat att act      868
Gly Asp Thr Ser Ile Asn Val Ile Asn Ser Gln Ile Asn Asp Ile Thr
265                 270                 275                 280

ctt ata cca agg gct ggt gga atg ctt gta ggt cct gtt acc cta gat      916
Leu Ile Pro Arg Ala Gly Gly Met Leu Val Gly Pro Val Thr Leu Asp
                285                 290                 295
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atc aca agc agt act ata caa aat ata caa tgt ggg cct gtc agt caa      964
Ile Thr Ser Ser Thr Ile Gln Asn Ile Gln Cys Gly Pro Val Ser Gln
            300                 305                 310

aat aat caa ctt aac aca cta aat gta act gtt aat act agt aac att     1012
Asn Asn Gln Leu Asn Thr Leu Asn Val Thr Val Asn Thr Ser Asn Ile
        315                 320                 325

act aac tta aac ctt ggt agt gtc gaa ggt cat aca ata tca act aca     1060
Thr Asn Leu Asn Leu Gly Ser Val Glu Gly His Thr Ile Ser Thr Thr
    330                 335                 340

gca act gtt act gat agt aat att act aac ctt aat gtc gga acc ttc     1108
Ala Thr Val Thr Asp Ser Asn Ile Thr Asn Leu Asn Val Gly Thr Phe
345                 350                 355                 360

aat gga ctt gga gta act gag aat gcc tct gta atc att aat agt ggc     1156
Asn Gly Leu Gly Val Thr Glu Asn Ala Ser Val Ile Ile Asn Ser Gly
                365                 370                 375

aat att act aac ctt aat gtc gga act aat gta ata gct gca gcc aca     1204
Asn Ile Thr Asn Leu Asn Val Gly Thr Asn Val Ile Ala Ala Ala Thr
            380                 385                 390

act att aat tcc tct gcg acc ata cac gac gga ctt att gca aac ctt     1252
Thr Ile Asn Ser Ser Ala Thr Ile His Asp Gly Leu Ile Ala Asn Leu
        395                 400                 405

acc tta ggc tca caa ggt aat ggt cgt act atg ata gct aca gca aat     1300
Thr Leu Gly Ser Gln Gly Asn Gly Arg Thr Met Ile Ala Thr Ala Asn
    410                 415                 420

gtt aat ggt gga act att gga tta tta act atg ggt tca gaa aac ttc     1348
Val Asn Gly Gly Thr Ile Gly Leu Leu Thr Met Gly Ser Glu Asn Phe
425                 430                 435                 440

ata cca ggc aca aga cca att act gaa tta gca ata cta aac atg tct     1396
Ile Pro Gly Thr Arg Pro Ile Thr Glu Leu Ala Ile Leu Asn Met Ser
                445                 450                 455

ggt gga tta att gaa aga att atc gta ggt aat gcc aac tct tca acc     1444
Gly Gly Leu Ile Glu Arg Ile Ile Val Gly Asn Ala Asn Ser Ser Thr
            460                 465                 470

ata aac ttt act cct ggg aag aga tca att gta aaa aca ata aat ggt     1492
Ile Asn Phe Thr Pro Gly Lys Arg Ser Ile Val Lys Thr Ile Asn Gly
        475                 480                 485

cca gaa ctt cca tat tta gtt aac ata caa aaa ggt gct atg aca caa     1540
Pro Glu Leu Pro Tyr Leu Val Asn Ile Gln Lys Gly Ala Met Thr Gln
    490                 495                 500

tgg ggc act aaa aat atg ccc ttt tta ttg gat aca aga aat tta atc     1588
Trp Gly Thr Lys Asn Met Pro Phe Leu Leu Asp Thr Arg Asn Leu Ile
505                 510                 515                 520

ttg tcc gga act ctg att acc tca aat att caa cta gct gat tta tct     1636
Leu Ser Gly Thr Leu Ile Thr Ser Asn Ile Gln Leu Ala Asp Leu Ser
                525                 530                 535

ata acc aat cta ttt gtt gct aat ggc ggt aca cta gta cct aga aaa     1684
Ile Thr Asn Leu Phe Val Ala Asn Gly Gly Thr Leu Val Pro Arg Lys
            540                 545                 550
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tta ata cct ggg aac caa cct gtt ata cag ttt ctt gga ggt cct caa     1732
Leu Ile Pro Gly Asn Gln Pro Val Ile Gln Phe Leu Gly Gly Pro Gln
        555                 560                 565

tca ctc tta gtt atc cat caa cca tta aaa gta aat tta agc tta tca     1780
Ser Leu Leu Val Ile His Gln Pro Leu Lys Val Asn Leu Ser Leu Ser
    570                 575                 580

cca aaa ctt att gga agt agc atg gtg cca ctt gct ttt gtc tct caa     1828
Pro Lys Leu Ile Gly Ser Ser Met Val Pro Leu Ala Phe Val Ser Gln
585                 590                 595                 600

tct ttt tca tca cca gat ctt ttt gtt aaa caa act aga agt ggt ctc     1876
Ser Phe Ser Ser Pro Asp Leu Phe Val Lys Gln Thr Arg Ser Gly Leu
                605                 610                 615

att tgg agt gat ctt gag ttt gat cca aca aca tct att tgg tat gtt     1924
Ile Trp Ser Asp Leu Glu Phe Asp Pro Thr Thr Ser Ile Trp Tyr Val
            620                 625                 630

aat aat atc caa gca tct caa gat ttt tac tct ttc tct att gct cgt     1972
Asn Asn Ile Gln Ala Ser Gln Asp Phe Tyr Ser Phe Ser Ile Ala Arg
        635                 640                 645

gag act act aac tgg cta aga caa caa cat ata tgg act cta caa aac     2020
Glu Thr Thr Asn Trp Leu Arg Gln Gln His Ile Trp Thr Leu Gln Asn
    650                 655                 660

cgt tca agt aaa ctt tta gac aac gaa cat tat gga cta tgg ata aat     2068
Arg Ser Ser Lys Leu Leu Asp Asn Glu His Tyr Gly Leu Trp Ile Asn
665                 670                 675                 680

gtt caa ggt gga cat gaa agt ctt gat act tct att ggt agc aaa gca     2116
Val Gln Gly Gly His Glu Ser Leu Asp Thr Ser Ile Gly Ser Lys Ala
                685                 690                 695

aaa atg cca tgg ata atg gca aca gca gga tat gac tat ctt caa caa     2164
Lys Met Pro Trp Ile Met Ala Thr Ala Gly Tyr Asp Tyr Leu Gln Gln
            700                 705                 710

cta cca agg tta gat atg aaa gcc ctt tat ggt ctt gct ttt ggt gct     2212
Leu Pro Arg Leu Asp Met Lys Ala Leu Tyr Gly Leu Ala Phe Gly Ala
        715                 720                 725

tct aaa ggt aaa agt aaa tgg tct agc gtc aac tct aca aaa aat gat     2260
Ser Lys Gly Lys Ser Lys Trp Ser Ser Val Asn Ser Thr Lys Asn Asp
    730                 735                 740

gct gag cta ggt atg gtt agt ggt tat gta ggt ctt atc cat aac aaa     2308
Ala Glu Leu Gly Met Val Ser Gly Tyr Val Gly Leu Ile His Asn Lys
745                 750                 755                 760

act ggg ctc tat agt aca ttg acc tta caa ctt gcg tct agt aaa tta     2356
Thr Gly Leu Tyr Ser Thr Leu Thr Leu Gln Leu Ala Ser Ser Lys Leu
                765                 770                 775

cat act aat tct aca ggg ttc tat aga aat ttt aaa tgg aca gaa aca     2404
His Thr Asn Ser Thr Gly Phe Tyr Arg Asn Phe Lys Trp Thr Glu Thr
            780                 785                 790

act cca aca gaa gca ctt gaa ctt gga tgg aaa tac act ttc aac aac     2452
Thr Pro Thr Glu Ala Leu Glu Leu Gly Trp Lys Tyr Thr Phe Asn Asn
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        795                 800                 805

ggt att aaa atg aat cct cgt gga caa ctt att ttt gaa caa aca tct     2500
Gly Ile Lys Met Asn Pro Arg Gly Gln Leu Ile Phe Glu Gln Thr Ser
    810                 815                 820

aaa cac cat ttt gat tta gga att caa aat gat aag gct ata tta gat     2548
Lys His His Phe Asp Leu Gly Ile Gln Asn Asp Lys Ala Ile Leu Asp
825                 830                 835                 840

aaa agc cag tta ata aca agt tct ctt ggt att acc gtt gaa tat aag     2596
Lys Ser Gln Leu Ile Thr Ser Ser Leu Gly Ile Thr Val Glu Tyr Lys
                845                 850                 855

cta cca gtt acc aca cct att aat ctt tat gct ggt att gaa agg ata     2644
Leu Pro Val Thr Thr Pro Ile Asn Leu Tyr Ala Gly Ile Glu Arg Ile
            860                 865                 870

aaa ggt cag tct gga aac ttt gca att agt tcc cag agc ctt caa atg     2692
Lys Gly Gln Ser Gly Asn Phe Ala Ile Ser Ser Gln Ser Leu Gln Met
        875                 880                 885

aag ttc aag cat gac aat gat aca agt gta gtt aga gca aca ata ggt     2740
Lys Phe Lys His Asp Asn Asp Thr Ser Val Val Arg Ala Thr Ile Gly
    890                 895                 900

aca aat ata tta ttg gga gaa cat ttt aat att cac tgt gat ata ttt     2788
Thr Asn Ile Leu Leu Gly Glu His Phe Asn Ile His Cys Asp Ile Phe
905                 910                 915                 920

gga gat aaa gga aat gat aaa ggc att ggt ggg caa gca gga ttt aca     2836
Gly Asp Lys Gly Asn Asp Lys Gly Ile Gly Gly Gln Ala Gly Phe Thr
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tac aaa ttt taa                                                    2848
Tyr Lys Phe
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Ser Leu Cys Val Phe Phe Phe Thr Leu Thr Glu Lys Gln Lys Ile Tyr
            20                  25                  30

Ala Ala Asp Val Phe Phe Glu Gly Arg Thr Glu Thr Leu Ile Asn Val
        35                  40                  45

Asn Lys Pro Phe Asp Ser Phe Phe Gly Gly Ser Asp Ser Thr Ile Gly
    50                  55                  60

Thr Leu Glu Thr Gly Pro Thr Asn Leu Thr Phe Thr Thr Val Gly Ala
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65 70 75 80

Phe Arg Asn Ser Val Phe Arg Ile Ile Gly Gly Gly Arg Ser Ser Phe
85 90 95

Asn Asn Pro Asn Thr Val Lys Gly Asn Val Thr Leu Thr Val Tyr Asn
100 105 110

Thr Asp Val Glu Arg Ile Ile Gly Ala Gly Ile Ser Asn Arg Gly Leu
115 120 125

Val Thr Val Thr Gly Ser Val Asn Met Lys Leu Glu Asn Val Ser Val
130 135 140

Thr Arg Gly Ile Tyr Gly Gly Val Tyr Thr Gln Asn Gly His Val Leu
145 150 155 160

Gly Ser Ile Asn Met His Leu Lys Asn Val Gln Thr Pro Leu Leu Ile
165 170 175

Gly Ser Gly Val Ser Asn Gly Pro Asn Arg Ile Thr Val Asn Gly Asp
180 185 190

Ile Asn Ile Asp Val Glu Asp Ser Arg Ile Gln Tyr Val Asn Ile Thr
195 200 205

Gly Glu Val Asp Ala Gly Ile Lys Gly Asn Ala Thr Leu Thr Val Lys
210 215 220

Lys Ser Thr Val Glu Leu Ile Asn Ser Gly Arg Gly Asn Ile Leu Gly
225 230 235 240

Asn Leu Lys Ile Ser Ile Ala Asp Ser Asn Ile Arg Gly Leu Ser Pro
245 250 255

Val Asp Phe Gly Ser Ser Val Tyr Gly Asp Thr Ser Ile Asn Val Ile
260 265 270

Asn Ser Gln Ile Asn Asp Ile Thr Leu Ile Pro Arg Ala Gly Gly Met
275 280 285

Leu Val Gly Pro Val Thr Leu Asp Ile Thr Ser Ser Thr Ile Gln Asn
290 295 300

Ile Gln Cys Gly Pro Val Ser Gln Asn Asn Gln Leu Asn Thr Leu Asn
305 310 315 320

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Val Thr Val Asn Thr Ser Asn Ile Thr Asn Leu Asn Leu Gly Ser Val
                325                 330                 335

Glu Gly His Thr Ile Ser Thr Thr Ala Thr Val Thr Asp Ser Asn Ile
            340                 345                 350

Thr Asn Leu Asn Val Gly Thr Phe Asn Gly Leu Gly Val Thr Glu Asn
        355                 360                 365

Ala Ser Val Ile Ile Asn Ser Gly Asn Ile Thr Asn Leu Asn Val Gly
    370                 375                 380

Thr Asn Val Ile Ala Ala Ala Thr Thr Ile Asn Ser Ser Ala Thr Ile
385                 390                 395                 400

His Asp Gly Leu Ile Ala Asn Leu Thr Leu Gly Ser Gln Gly Asn Gly
                405                 410                 415

Arg Thr Met Ile Ala Thr Ala Asn Val Asn Gly Gly Thr Ile Gly Leu
            420                 425                 430

Leu Thr Met Gly Ser Glu Asn Phe Ile Pro Gly Thr Arg Pro Ile Thr
        435                 440                 445

Glu Leu Ala Ile Leu Asn Met Ser Gly Gly Leu Ile Glu Arg Ile Ile
    450                 455                 460

Val Gly Asn Ala Asn Ser Ser Thr Ile Asn Phe Thr Pro Gly Lys Arg
465                 470                 475                 480

Ser Ile Val Lys Thr Ile Asn Gly Pro Glu Leu Pro Tyr Leu Val Asn
                485                 490                 495

Ile Gln Lys Gly Ala Met Thr Gln Trp Gly Thr Lys Asn Met Pro Phe
            500                 505                 510

Leu Leu Asp Thr Arg Asn Leu Ile Leu Ser Gly Thr Leu Ile Thr Ser
        515                 520                 525

Asn Ile Gln Leu Ala Asp Leu Ser Ile Thr Asn Leu Phe Val Ala Asn
    530                 535                 540

Gly Gly Thr Leu Val Pro Arg Lys Leu Ile Pro Gly Asn Gln Pro Val
545                 550                 555                 560

Ile Gln Phe Leu Gly Gly Pro Gln Ser Leu Leu Val Ile His Gln Pro
                565                 570                 575
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Leu Lys Val Asn Leu Ser Leu Ser Pro Lys Leu Ile Gly Ser Ser Met
            580                 585                 590

Val Pro Leu Ala Phe Val Ser Gln Ser Phe Ser Ser Pro Asp Leu Phe
        595                 600                 605

Val Lys Gln Thr Arg Ser Gly Leu Ile Trp Ser Asp Leu Glu Phe Asp
    610                 615                 620

Pro Thr Thr Ser Ile Trp Tyr Val Asn Asn Ile Gln Ala Ser Gln Asp
625                 630                 635                 640

Phe Tyr Ser Phe Ser Ile Ala Arg Glu Thr Thr Asn Trp Leu Arg Gln
                645                 650                 655

Gln His Ile Trp Thr Leu Gln Asn Arg Ser Ser Lys Leu Leu Asp Asn
            660                 665                 670

Glu His Tyr Gly Leu Trp Ile Asn Val Gln Gly Gly His Glu Ser Leu
        675                 680                 685

Asp Thr Ser Ile Gly Ser Lys Ala Lys Met Pro Trp Ile Met Ala Thr
    690                 695                 700

Ala Gly Tyr Asp Tyr Leu Gln Gln Leu Pro Arg Leu Asp Met Lys Ala
705                 710                 715                 720

Leu Tyr Gly Leu Ala Phe Gly Ala Ser Lys Gly Lys Ser Lys Trp Ser
                725                 730                 735

Ser Val Asn Ser Thr Lys Asn Asp Ala Glu Leu Gly Met Val Ser Gly
            740                 745                 750

Tyr Val Gly Leu Ile His Asn Lys Thr Gly Leu Tyr Ser Thr Leu Thr
        755                 760                 765

Leu Gln Leu Ala Ser Ser Lys Leu His Thr Asn Ser Thr Gly Phe Tyr
    770                 775                 780

Arg Asn Phe Lys Trp Thr Glu Thr Thr Pro Thr Glu Ala Leu Glu Leu
785                 790                 795                 800

Gly Trp Lys Tyr Thr Phe Asn Asn Gly Ile Lys Met Asn Pro Arg Gly
                805                 810                 815

Gln Leu Ile Phe Glu Gln Thr Ser Lys His His Phe Asp Leu Gly Ile
            820                 825                 830
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Gln Asn Asp Lys Ala Ile Leu Asp Lys Ser Gln Leu Ile Thr Ser Ser
835 840 845

Leu Gly Ile Thr Val Glu Tyr Lys Leu Pro Val Thr Thr Pro Ile Asn
850 855 860

Leu Tyr Ala Gly Ile Glu Arg Ile Lys Gly Gln Ser Gly Asn Phe Ala
865 870 875 880

Ile Ser Ser Gln Ser Leu Gln Met Lys Phe Lys His Asp Asn Asp Thr
885 890 895

Ser Val Val Arg Ala Thr Ile Gly Thr Asn Ile Leu Leu Gly Glu His
900 905 910

Phe Asn Ile His Cys Asp Ile Phe Gly Asp Lys Gly Asn Asp Lys Gly
915 920 925

Ile Gly Gly Gln Ala Gly Phe Thr Tyr Lys Phe
930 935